Uttarakhand Technical University

Program: B.Tech

Year: 3 Mechanical Engg. Session: 2011-2012

Scheme and Evaluation Pattern

Semester: V

S. No	Course NO.	Subject	Periods			Evaluation				Total Marks
			L	T	P	Sessional			External Exam	
						CT	TA	Total		
Theory										
1	TME-501	Mechanical Vibrations	3	1	0	30	20	50	100	150
2	TME-502	Machine Design I	3	1	0	30	20	50	100	150
3	TME-503	Dynamics Of Machine	3	1	0	30	20	50	100	150
4	TME-504	Manufacturing Science II	3	1	0	30	20	50	100	150
5	TME-505	Heat and Mass Transfer	3	1	0	30	20	50	100	150
6	TCS-507	Concepts of programming and OOPS	2	1	0	15	10	25	50	75
Practical										
1	PME-552	Theory of Machine and design Lab	0	0	2	0	0	25	25	50
2	PME-555	Heat and Mass Transfer	0	0	2	0	0	25	25	50
3	PCS-557	Application of programming and OOPS Lab	0	0	2	0	0	0	25	25
4	PME 558	Discipline								50
Total										1000

L- Lecture, **T**- Tutorial, **P**- Practical, **CT**- Class Test comprising of two testes in a semester each of 15 Marks, **TA**- Teacher Assessment comprising of Attendance and Home Assignments & Tutorial tests in a semester each 10 marks

Uttarakhand Technical University

Program: B.Tech

Year: 3 Mechanical Engg. Session: 2011-2012

Scheme and Evaluation Pattern

Semester: VI

S.No	Course NO.	Subject	Periods			Evaluation				Total Marks
			L	T	P	Sessional			External Exam	
						CT	TA	Total		
Theory										
1	TME-601	Operation Research	3	1	0	30	20	50	100	150
2	TME-602	IC Engine	3	1	0	30	20	50	100	150
3	TME-603	Machine Design II	3	1	0	30	20	50	100	150
4	TME-604	Fluid Machinery	3	1	0	30	20	50	100	150
5	TME-605	Refrigeration and Air Conditioning	3	1	0	30	20	50	100	150
6	THU-608	Principle Of Management	2	1	0	15	10	25	50	75
Practical										
1	PME 653	Machine Design II Lab	0	0	2	0	0	25	25	50
2	PME 654	Fluid Machinary Lab	0	0	2	0	0	25	25	50
3	PME 655	Refrigeration and Air Conditioning Lab	0	0	2	0	0	0	25	25
4	PME 657	Seminar								50
Total										1000

L- Lecture, **T**- Tutorial, **P**- Practical, **CT**- Class Test comprising of two testes in a semester each of 15 Marks, **TA**- Teacher Assessment comprising of Attendance and Home Assignments & Tutorial tests in a semester each 10 marks

Uttarakhand Technical University

Program: B.Tech

Year: 4 Mechanical Engg. Session: 2012-2013

Scheme and Evaluation Pattern

Semester: VII

S.No	Course NO.	Subject	Periods			Evaluation				Total Marks
			L	T	P	Sessional			External Exam	
						CT	TA	Total		
Theory										
1	TME-701	CAD/CAM	3	1	0	30	20	50	100	150
2	TME-702	Maintenance & Safety	3	1	0	30	20	50	100	150
3	TME-703	Energy Conservation	3	1	0	30	20	50	100	150
4	TME-XXX	Elective I	3	1	0	30	20	50	100	150
5		Open Elective I	3	1	0	30	20	50	100	150
Practical										
1	PME-751	CAD/CAM Lab	0	0	2	0	0	25	25	50
2	PME-752	Industrial Training	0	0	2	0	0	25	25	50
3	PME-753	Project						100		100
4	PME-754	Seminar						50		50
Total										1000

L- Lecture, **T**- Tutorial, **P**- Practical, **CT**- Class Test comprising of two testes in a semester each of 15 Marks, **TA**- Teacher Assessment comprising of Attendance and Home Assignments & Tutorial tests in a semester each 10 marks

Uttarakhand Technical University

Program: B.Tech

Year: 4 Mechanical Engg. Session: 2012-2013

Scheme and Evaluation Pattern

Semester: VIII

S.No	Course NO.	Subject	Periods			Evaluation				Total Marks
			L	T	P	Sessional			External Exam	
						CT	TA	Total		
Theory										
1	TME-801	Power Plant Engineering	3	1	0	30	20	50	100	150
2	TME-802	Automobile Engineering	3	1	0	30	20	50	100	150
3	TME-XXX	Elective II	3	1	0	30	20	50	100	150
4	TME-XXX	Elective III	3	1	0	30	20	50	100	150
Practical										
1	PME-852	Automobile Engg. Lab	0	0	2	0	25	25	25	50
2	PME-853	Project	0	0	2	0	100	100	200	300
3	PME-854	Discipline								50
Total										1000

L- Lecture, **T**- Tutorial, **P**- Practical, **CT**- Class Test comprising of two testes in a semester each of 15 Marks, **TA**- Teacher Assessment comprising of Attendance and Home Assignments & Tutorial tests in a semester each 10 marks

TME-501 MECHANICAL VIBRATIONS **L T P**

3 1 0

UNIT- I

INTRODUCTION:

Periodic motion, harmonic motion, superposition of simple harmonic motions, beats, fourier analysis. Single **4**

Degree Freedom System: Free vibration, Natural frequency, Equivalent Systems, Energy method for determining natural frequency, Response to an initial disturbance, **3**

Torsional vibrations, Damped vibrations. Damping models – Structural, Coulomb and Viscous damping, Vibrations of system with viscous damping, Logarithmic decrement, Viscous dampers. **3**

UNIT- II

Single Degree Freedom: Forced vibration, Harmonic Excitation with viscous damping, Steady state vibrations, **4**

Forced vibrations with rotating and reciprocating unbalance, Support excitation, **2**

Vibration isolation, Transmissibility, Vibration measuring instruments- Displacement, Velocity, Acceleration and Frequency measuring instrument. **4**

UNIT- III

Two Degree Freedom System: Introduction, Principal modes, Double pendulum, Torsional system with damping, **3**

Coupled System, Undamped dynamic, vibration absorbers, Centrifugal pendulum absorber, Dry friction damper, Untuned viscous damper. **4**

UNIT- IV

Multidegree Freedom System: Exact Analysis Undamped free and forced vibrations of multidegree system, **2**

Influence numbers, Reciprocal Theorem, Torsional vibration of multi rotor system, Vibration of geared system, **3**

Principal coordinates, Continuous systems- Longitudinal vibration of bars, Torsional vibrations of Circular shafts, Lateral vibration of beams. **3**

UNIT- V

Multidegree Freedom System: Numerical Analysis Rayleigh's, Dunkerley's, Holzer's and Stodola's methods, Rayleigh – Ritz method. **4**

Critical Speed of Shafts: Shafts with one disc with and without damping, Multi-disc shafts, Secondary critical speed. **3**

Reference Books :

1. Mechanical Vibration –Magreb, Cengage India, New Delhi

2. Mechanical Vibration Practice with Basic Theory – V. Rama Murthy – Narosa Publishers

3. Machanical Vibrations – S.S. Rao, Pearson

4. Mechanical Vibration- Palm, Wiley India, New Delhi

TME-502 MACHINE DESIGN –I **L T P**
3 1 0

UNIT-I

Introduction, Definition, Methods, standards in design & selection of preferred size. **3**

Selection of materials for static & fatigue loads, Materials for components subjected to creep, BIS system of designation of steels, steels, plastics & rubbers. AISI (American Iron & Steel Institution), ASTM rubber testing methods. **4**

UNIT-II

Design against static load.

Modes of failure, Factor of safety, stress-strain relationship, principal stresses, theories of failure **4**

Design against fluctuating load stress concentration, stress concentration factors, Fluctuating/alternting stresses, fatigue failure, endurance limit, design for finite & infinite life, Soderberg & Goodman criteria. **4**

UNIT-III

Design Of Joints

Welded joint, screwed joints, ecentric loading of above joints, Joint design for fatigue loading. **3**

Shaft, keys & coupling.

Design against static and fatigue loads, strength & rigidity design, Selection of square & flat keys & splines, rigid & flexible couplings. **4**

UNIT-IV

Mechanical springs

Design of Helical and leaf springs, against static & fatigue loading. **4**

Design analysis of Power Screws

Form of threads, square threads, trapezoidal threads, stresses in screw, design of screw jack. **4**

UNIT-V

Introduction to Product Development & Design Process

Definition of Design, Design Process, Need Analysis, Need based developments, Design by Evolution, Technology based developments, Examples. Case Studies. Brain-storming. **8**

References

1. Design of Machine Elements : Bhandari, TMH
2. Machine design : Sharma & Aggarwal, Katsons publications
3. Mechanical Design, Theory and Metholodogy, Waldraon, BSP, Hyderabad
4. M/C Design : Maleev & Hartman
5. Machine Design, Robert L Norton, Pearson
6. Machine Design –U C Jindal, Pearson

TME-503 DYNAMICS OF MACHINES **L T P**
UNIT-I **3 1 0**

Force Analysis, Turning Moment & Fly wheel:
Static force analysis of linkages, Equivalent offset inertia force, Dynamic analysis of slider crank & Bar mechanism. Piston and Crank effort, Inertia, Torque, Turning moment diagrams, Fluctuation of energy, Flywheel. **4**

UNIT-II Balancing of machines:
Static and dynamic balancing, Balancing of rotating and reciprocating masses, Primary and secondary forces and couples. **5**

UNIT-III Friction:
Pivot and collar friction, Friction circle, Single plate, Multiplate and Cone clutches, Michelle & Kingsbury thrust bearing and rolling contact bearing, Belts and pulleys, Flat and V-belts, Design and selection. **7**

Brakes and Dynamometers (Mechanical Type):
External and internal shoe brakes, Band and Block brakes, Hydraulic brakes, Absorption and Transmission dynamometers. **7**

UNIT-IV
Governors:
Dead weight and spring loaded governors, Sensitivity, Stability, Hunting, Isochronisms, Effort and Power, Friction and Insensitivity, Introduction to inertia governors. **6**

UNIT - V
Gyroscopic Motion:
Principles, Gyroscopic acceleration, gyroscopic couple and Reaction. Effect of Gyroscopic couple upon the stability of aero planes, ship, two & four wheelers. **4**

References
1.Theory of Machine: Thomas Bevan (Pearson)
2.Theory of Machine: S.S.Ratan (TMH)
3. Kinematics, Dynamics & Design of Machinery-Waldron (Pearson)

TCS-507 CONCEPTS OF PROGRAMMING AND OOPS **L T P**
2 1 0

UNIT 1

UTILIZATION: Developer fundamentals such as editor, integrated programming environment, UNIX shell, modules, libraries. 2

PROGRAMMING FEATURES: Machine representation, primitive types, arrays and records, objects, expressions, control statements, iteration, procedures, functions, and basic I/O.

APPLICATIONS: Sample problems in engineering, science, text processing, and numerical methods. 5

UNIT 2

PROBLEM SOLVING WITH ALGORITHMS- Programming styles – Coding Standards and Best practices - Introduction to C Programming, Testing and Debugging. Code reviews, System Development Methodologies – Software development Models, User interface Design – introduction – The process – Elements of UI design & reports. 5

UNIT 3

OBJECTED ORIENTED CONCEPTS – object oriented programming, UML Class Diagrams– relationship – Inheritance – Abstract classes – polymorphism, Object Oriented Design methodology - Common Base class, Alice Tool – Application of OOC using Alice tool. 4

UNIT 4

RDBMS- DATA PROCESSING – the database technology – data models, ER modeling concept –notations – Extended ER features, Logical database design – normalization, SQL – DDL statements – DML statements – DCL statements, Writing Simple queries – SQL Tuning techniques – Embedded SQL – OLTP 8

REFERENCES:

1.Computer Concepts and C Programming by Vikas Gupta, Wiley India

2.Introduction to Computers by Peter Norton, TMH

3. G. Dromey, How to Solve It by Computer, Pearson

4.Programming in ANSI C by Balaguruswamy, TMH

TME-504 MANUFACTURING SCIENCE-II ` **L T P**
3 1 0

Unit-I

A Metal Cutting and Machine Tools

Metal Cutting-
Mechanics of metal cutting. Geometry of tool and nomenclature .ASA system Orthogonal vs. oblique cutting. Mechanics of chip formation, types of chips. Shear angle relationship. Merchant's force circle diagram. Cutting forces, power required. Cutting fluids/lubricants. Tool materials. Tool wear and tool life. Machinability. Brief introduction to machine tool vibration and surface finish. Economics of metal cutting. **8**

Unit-II

Machine Tools
(i) Lathe : Principle, types, operations, Turret/capstan, semi/Automatic, Tool layout. **2**
(ii) Shaper, slotter, planer : operations & drives. **1**
(iii) Milling : Milling cutters, up & down milling. Dividing head & indexing. Max chip thickness & power required. **2**
(iv) Drilling and boring : Drilling, boring, reaming tools. Geometry of twist drills. **2**

Unit-III

Grinding & Super finishing
(v) Grinding : Grinding wheels, abrasive, cutting action. Grinding wheel specification. Grinding wheel wear - attritions wear, fracture wear. Dressing and Truing. Max chip thickness and Guest criteria. Surface and Cylindrical grinding. Centerless grinding. **4**
(vi) Super finishing : Honing, lapping, polishing. **1**

Limits, Fits & Tolerance and Surface-roughness:
Introduction to Limits, Fits, Tolerances and IS standards, and surface-roughness. **3**

Unit-IV

B. Metal Joining (Welding)
Survey of welding and allied processes. Gas welding and cutting, process and equipment. Arc welding : Power sources and consumables. TIG & MIG processes and their parameters. Resistance welding - spot, seam projection etc. Other welding processes such as atomic hydrogen, submerged arc, electroslag, friction welding. Soldering & Brazing . **8**

Thermodynamic and Metallurgical aspects in welding and weld,. Shrinkage/residual stress in welds. Distortions & Defects in welds and remedies. Weld decay in HAZ. **3**

Unit-V

C. Introduction to non conventional Manufacturing Process

Benefits, application and working principle of EDM, ECM, LBM, EBM, USM. AJM, WJM. Similarly, non-conventional welding application such as LBW, USW, EBW, Plasma arc welding, Explosive welding. HERE- Explosive Forming **6**

Books

1. Modern Machining Processes by P.C. Pandey & H.S. Shan
2. Manufacturing science by Degarmo, Wiley India
3. Manufacturing Technology Metal Cutting & Machine Tools by PN Rao, TMH
4. Manufacturing Process by Sontosh Bhatnagar, BSP Hyderabad

TME-505 HEAT & MASS TRANSFER **L T P**
3 1 0

UNIT-1

Introduction to Heat Transfer:
Concepts of heat flows: conduction, convection and radiation; effect
Of temperature on thermal conductivity of materials; introduction to combined heat transfer mechanism. **2**

Conduction :
One-dimensional general differential heat conduction equation in the rectangular,initial and boundary conditions. **3**

Steady State one-dimensional Heat conduction :
Composite Systems in rectangular, cylindrical and spherical coordinates with and without
Energy generation; thermal resistance concept; Analogy between heat and electricity flow;
thermal contact resistance;Overall Heat Transfer Coefficient,critical thickness of insulation.
3

UNIT-2
Types of fins, Fins of uniform cross-sectional area; errors of measurement of temperature in thermometer wells.
2

Transient Conduction:
Transient heat conduction Lumped capacitance method, unsteady state heat conduction in one dimension only, Heisler charts. **4**

UNIT-3

Forced Convection:
Basic concepts; hydrodynamic boundary layer; thermal boundary layer, flow over a flat
plate; flow across a single cylinder and a sphere; flow inside ducts; empirical heat transfer relations; relation between fluid friction and heat transfer; liquid metal heat transfer. **4**

Natural Convection :
Physical mechanism of natural convection; buoyant force; empirical heat transfer
relations for natural convection over vertical planes and cylinders, horizontal plates and Cylinders, and sphere. **5**

UNIT-4

Thermal Radiation :
Basic radiation concepts; radiation properties of surfaces; black body radiation laws;
shape factor; black-body radiation exchange; Radiation exchange between non-blackbodies in an enclosure; Infinite parallel Planes, radiation shields; **7**

UNIT-5

Heat Exchanger :
Types of heat exchangers; fouling factors; overall heat transfer coefficient; logarithmic Mean temperature difference (LMTD) method; effectiveness-NTU method; compact heat Exchangers, Steam distribution systems.

Condensation And Boiling :
Introduction to condensation phenomena; heat transfer relations for laminar film condensation on vertical surfaces and on a horizontal tube; Boiling modes pool boiling, curve, forced convective boiling. **3**

Introduction To Mass Transfer :
Introduction; Flick's law of diffusion; steady state equimolar counter diffusion; steady state diffusion though a stagnant gas film. **2**

Books
1. Elements of Heat transfer by Cengel, TMH
2. Heat and mass transfer, M.Thirumaleswar, Pearson
3. Fundamentals of Heat & Mass Transfer by Incropera Wiley India
4.Heat & Mass Transfer by Khurmi, Schand,New Delhi

PME 551 THEORY OF MACHINE & DESIGN LAB **L T P**
0 0 2

(Min 3 out of these)
1. Design & drawing of a cotter joint.
2. Design & drawing of a knuckle joints.
3. Design & drawing of a simple screw jack.
4. Design of shaft for different loading conditions.
5. Design & drawing of rigid coupling(flanged type).
6. Design & drawing of a leaf spring for an automobile.
7. Design & drawing of a helical spring for a given application

Note -
1. Students may be advised to use design data book for design.
2. Drawing shall be made wherever necessary on small drawing sheets.

Min. 5 out of following (or such) experiments to be done:
1. Study of simple linkers/models/mechanisms.
2. Exp. on Velocity acceleration.
3. Exp. on cam.
4. Exp. on Governor.
5. Exp. on critical speed of shaft (whirling of shaft)
6. Exp. on Gyroscope
7. Exp. on Balancing (static & dynamic)
8. Exp. on 4-bar mechanism
9. Exp. on Gears (tooth profile, interference etc.)
10. Exp. on Gear trains.
11. Exp. on Mechanism
15. Exp. on Vibration (spring)

TME-555 HEAT & MASS TRANSFER – LAB **L T P**

(min 8 experiment of the following or such experiment) **0 0 2**

1. Conduction - Composite wall experiment
2. Conduction - Composite cylinder experiment
3. Convection - Pool Boiling experiment
4. Convection - Experiment on heat transfer from tube-natural convection.
5. Convection - Heat Pipe experiment.
6. Convection - Heat transfer through fin-natural convection .
7. Convection - Heat transfer through tube/fin-forced convection.
8. Any experiment - Such as on Stefen's Law,
on radiation detrmination of emissivity, etc.
9. Any experiment - Such as on solar collector, etc.
on radiation
10. Heat exchanger - Parallel flow experiment
11. Heat exchanger - Counter flow experiment
12. Any other suitable exp such as on critical insultation thickness.
13. Conduction - Determination of thermal conductivity of fluids.
14. Conduction - Thermal Contact Resistance Effect.

TME 601 OPERATIONS RESEARCH **L T P**
3 1 0

Unit 1: Introduction:
Linear programming, Definition, scope of Operations Research (O.R) approach and limitations of OR Models, Characteristics and phases of OR Mathematical formulation of L.P. Problems. Graphical solution methods. **6**

Linear Programming Problems:
The simplex method - slack, surplus and artificial variables. Concept of duality, two phase method, dual simplex method, degeneracy, and procedure for resolving degenerate cases. **7**

Unit 2: Transportation Problem:
Formulation of transportation model, Basic feasible solution using different methods, Optimality Methods,
Unbalanced transportation problem, Degeneracy in transportation problems, Applications of Transportation
problems. **7**
Assignment Problem: Formulation, unbalanced assignment problem, traveling problem. **6**

Unit 3: Game Theory:
Formulation of games, two person-Zero sum game, games with and without saddle point, Graphical solution (2x n, m x 2 game), dominance property. **6**

Unit 4: Queuing Theory:
Queuing system and their characteristics. The M/M/1 Queuing system, Steady state performance analyzingof M/M/ 1 and M/M/C queuing model. **6**

Unit 5: PERT-CPM Techniques:
Network construction, determining critical path, floats, scheduling by network, project duration, variance under probabilistic models, prediction of date of completion, crashing of simple networks. **8**

Reference :
1. Taha H. A. - Operations Research , Pearson
2. Operations Research: Principles and practice: Ravindran, Phillips & Solberg, Wiley India ltd
3. AM Natarajan, P.Balasubramani , ATamilaravari “Operation research” Pearson 2005
4. Introduction to operation research: Theory and Applications, Springer BSP, Hyderabad
5.S D Sharma-Operations Research, Kedarnath Ramnath

TME 602 I C ENGINES **L T P**
3 1 0

Unit-1

Introduction to I.C Engines:
Engine classification, Air standard cycles, Otto, Diesel, Stirling, Ericsson cycles, Actual Cycle analysis, Two and four stroke engines, SI and CI engines, Valve timing diagram, Rotary engines, stratified charge engine. **5**

Fuels:
Fuels for SI and CI engine , important qualities of SI engine fuels, Rating of SI engine fuels, Important qualities of CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines. **3**

Unit–2

SI Engines:
Carburetion, Mixture requirements, Carburetor types Theory of carburetor, MPFI. **3**
Combustion in SI engine, Flame speed, Ignition delay, Abnormal combustion and it's control, combustion chamber design for SI engines. **2**

Ignition system requirements, Magneto and battery ignition systems, ignition timing and spark plug, Electronic ignition, battery and its types, Charging and discharging of batteries **2**

Unit–3 CI Engine:
Fuel injection in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timings. **4**
Combustion in CI engines, Ignition delay, Knock and it's control, Combustion chamber design of CI engines. **2**
Scavenging in 2 Stroke engines, pollution and it's control. **2**

Unit-4

Engine Cooling: Different cooling systems, Cooling Towers, Radiators and cooling fans. **2**

Lubrication: Engine friction, Lubrication principal, Type of lubrication ,Lubrication oils, Crankcase ventilation. **2**

Supercharging: Effect of altitude on power output, Types of supercharging. **2**

Testing and Performance: Performance parameters, Basic measurements, Blow by measurement, Testing of SI and CI engines. **4**

Unit-5

Compressors:
Classification, Reciprocating compressors, Single and multi stage, Intercooling, Volumetric efficiency. **3**

Rotary compressors, Classification, Centrifugal compressor, Elementary theory ,Vector Diagram efficiencies, Elementary analysis of axial compressors. **4**

BOOKS:
I.C. Engines by Ganeshan ,TMH
I C Engines by Ferguson, Wiley India
A Course in International Combustion Engines, by Mathur & Sharma, Dhanpat Rai & Sons.
Reciprocating and Rotary Compressors, by Chlumsky, SNTI Publications Czechoslovakia .
I.C Engine Analysis & Practice by E.F Obert.
I.C Engine, by Ganeshan, TMH
I.C Engine, by R. Yadav, Central Publishing House, Allahabad

TME-603 : MACHINE DESIGN-II **L T P**
3 1 0

UNIT I

Spur Gears Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods, Design considerations, Beam strength of gear tooth, Dynamic tooth load, Wear strength of gear tooth, Failure of gear tooth, Design of spur gears, AGMA and Indian standards. **5**

Helical Gears Terminology, Proportions for helical gears, Beam strength and wear strength of helical gears, herringbone gears, crossed helical gears, Design of helical gears. **3**

Worm Gears Types of worms, Terminology, Gear tooth proportions, Efficiency of worm gears, Heat dissipation in worm gearing, Strength and wear tooth load for worm gears, Design of worm gearing **3**

UNIT II

Sliding Contact Bearing Types, Selection of bearing, Plain journal bearing, Hydrodynamic lubrication, Properties and materials, Lubricants and lubrication, Hydrodynamic journal bearing, Heat generation, Design of journal bearing, Thrust bearing-pivot and collar bearing, Hydrodynamic thrust bearing**, 5**

Rolling Contact Bearing Advantages and disadvantages, Types of ball bearing, Thrust ball bearing, Types of roller bearing, Selection of radial ball bearing, Bearing life, Selection of roller bearings, Dynamic equivalent load for roller contact bearing under constant and variable loading, Reliability of Bearing, Selection of rolling contact bearing, Lubrication of ball and roller bearing, Mounting of bearing.

6

Recommended Books

Mechanical Design Theory and methodology by Waldron, Springer India

Machine Design by Juvinall, Wiley India , New Delhi

Handbook of Gear Design by Maitra ,TMH

Shigleys Mechanical Engineering Design ,TMH

UNIT III

IC ENGINE PARTS

Selection of type of IC engine, General design considerations, Design of Cylinder and cylinder head; Design of piston, piston ring and gudgeon pin; Design of connecting rod; Design of centre crankshaft **6**

References:

1. Mechanical Engineering Design – Joseph E. Shigely, McGraw Hill Publications

2. Design of Machine Memebers-Alex Valance and VI Doughtie, McGraw Hill Co.

3. Machine design-M.F. Spott, Prentice Hall India

4. Machine Design-Maleev and Hartman, CBS

5. Machine design -Black & Adams, Mc Graw Hill

6. Machine Design-Sharma and Agrawal, S.K. Katara & Sons

7. Design of Machine Elements-V.B. Bhandari, Tata McGraw Hill Co.

TME 604 FLUID MACHINERY **L T P**
3 1 0

Introduction:
Classification of Fluid Mechanics, Application of momentum and momentum equation to flow through hydraulic machinery, Euler's fundamental equation. **5**

Impact of jet:
Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat & curve), effect of inclination of jet with the surface. **3**

Hydraulic Turbines:
Classification of turbines, Impulse turbines, constructional details, velocity triangles, power and efficiency calculations, governing of Pelton wheel. **9**

UNIT-II

Reaction Turbines:
Fransis and Kaplan turbines, constructional details, velocity triangles, power and efficiency calculations, degree of reaction, draft tube, cavitation in turbines, principles of similarity, unit and specific speed, performance characteristics, selection of water turbines. **9**

UNIT-III

Centrifugal Pumps:
Classifications of centrifugal pumps, vector diagram, work done by impellor, efficiencies of centrifugal pumps, specific speed, model testing, cavitation and separation, performance characteristics. **7**

UNIT-IV

Positive Displacement Pumps:
Reciprocating pump theory, slip and coefficient of discharges, indicator diagram, effect and acceleration, work saved by fitting air vessels, comparison of centrifugal and reciprocating pumps, positive rotary pumps, Gear and Vane pumps, performance characteristics. **7**

UNIT-V

Other Machines:
Hydraulic accumulator, Intensifier, Hydraulic press, Lift and Cranes, theory of hydraulic coupling and torque converters, performance characteristics. **5**

Water Lifting Devices: Hydraulic ram, Jet pumps, Airlift pumps**,** water distribution systems. **3**

References:

Fluid Mechanics and Hydraulic Machines by S C Gupta, Pearson
Fundmanetals of Fluid Mechanics by Munson, Pearson
Hydraulic Machines by Jagdish Lal, Metropolitan book co. pvt ltd.
Hydraulic Machines: Theory & Design, V.P.Vasandhani, Khanna Pub.
Hydraulic Machines by R K Rajput, S.Chand & co Ltd.
Hydraulic Machines by D S Kumar

TME 605 REFRIGERATION & AIR CONDITIONING **L T P**
3 1 0

Unit-1

Refrigeration:
Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of refrigeration, Refrigeration effect & C.O.P. Air Refrigeration cycle: Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Boot strap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature (DART). **8**

Unit-2

Vapour Compression System:
Single stage system, Analysis of vapour compression cycle, use of T-S and P-H charts, Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration cycle, Different configuration of multistage system, Cascade system. **8**

Unit-3

Vapour Absorption system;
Working Principal of vapour absorption refrigeration system, Comparison between absorption & compression systems, Ammonia – Water vapour absorption system, Lithium-Bromide water vapour absorption system, Comparison. **5**

Refrigerants:
Classification, Nomenclature, Desirable properties of refrigerants, Common refrigerants, Secondary refrigerants and CFC free refrigerants. **3**

Unit-4

Air Conditioning:
Introduction to air conditioning, Psychometric properties and their definitions, Psychometric chart, Different Psychometric processes, Thermal analysis of human body Effective temperature and comfort chart, Cooling and heating load calculations, Infiltration & ventilation, Internal hear gain, Sensible heat factor (SHF), By pass factor, Grand Sensible heat factor (GSHF), Apparatus dew point (ADP). **9**

Unit-5

Refrigeration Equipment & Application:
Elementary knowledge of refrigeration & air conditioning equipments e.g compressors, condensers, evaporators & expansion devices, Air washers, Cooling, towers & humidifying efficiency, Food preservation, cold storage, Refrigerates Freezers, Icc plant, Water coolers, Elementary knowledge of transmission and distribution of air through ducts and fans, Basic difference between comfort and industrial air conditioning. **7**

Books:
Refrigeration and Air conditioning by C.P Arora.TMH
Refrigeration and Air conditioning by Arora & Domkundwar.Dhanpat Rai
Refrigeration and Air conditioning by stoecker & Jones.
Refrigeration and Air conditioning by Roy J. Dossat.Pearson
Heating Ventilating and Air conditioning by Mcquiston
Thermal Environment Engg. by Kuhen, Ramsey & Thelked. Central Book Agency.
ASHRAE Handbooks

THU-608

PRINCIPLES OF MANAGEMENT **L T P**
2 1 0

UNIT 1

INTRODUCTION TO MANAGEMENT: Theories of management: Traditional behavioral, contingency and systems approach. Organization as a system. 4

UNIT 2

MANAGEMENT INFORMATION: Interaction with external environment. Managerial decision making and MIS. 4

UNIT 3

PLANNING APPROACH TO ORGANIZATIONAL ANALYSIS: design of organization structure; job design and enrichment; job evaluation and merit rating. 3

UNIT 4

MOTIVATION AND PRODUCTIVITY: Theories of motivation, leadership styles and managerial grid. Co-ordination, monitoring and control in organizations. Techniques of control. Japanese management techniques. Case studies. 7

TEXT BOOK:

1.Schermerhorn,; Management and Organisational Behaviour essentials, Wiley India
2. Koontz: Essentials of Management, PHI Learning.
3. Hirschey: Managerial Economics, Cengage Learning.
4.A V Rau: Management Science, BSP, Hyderabad
5.Mote, l Paul and Gupta: Managerial Economics Concepts & Cases, TMH, New Delhi.
6.Stephan R Robbins Fundamental of Management, Pearson

TME-654 FLUID MACHINERY LAB **L T P**
0 0 2

(Say min 8 experiments from following or such experiment)

1. Impact of Jet experiment.
2. Turbine exp. on Pelton wheel.
3. Turbine exp. on Francis turbine.
4. Tubrine exp. on Kaplan turbine.
5. Exp. on Reciprocating pump.
6. Exp. on centrifugal pump.
7. Exp. on Hydraulic Jack/Press
8. Exp. on Hydraulic Brake
9. Exp. on Hydraulic Ram
10. Study through first visit of any pumping station/plant
11. Study through second visit of any pumping station/plant.
12. Any other suitable experiment/test rig such as comparision & performance of different types of
pumps and turbines.

TME-655

REFRIGERATION & AIR CONDITIONING LAB **L T P**

Say min 8 out of following **0 0 2**

1. Experiment on refrigeration test ring and calculation of various proformance parameters.
2. To study different types of expansion devices used in refrigreation system.
3. To study different types of evaporators used in refrigeration systems.
4. To study basic components of air-conditioning system.
5. Experiment on air-conditioning test rig & calculation of various performance parameters.
6. To study air washers
7. Study of window air conditioner.
8. Study & determination of volumetric efficiency of compressor.
9. Visit of a central air conditioning plant.
10. Visit of cold storage.

TME 701 CAD/CAM **L T P**
3 1 0

UNIT I :
CAD TOOLS: Definition of CAD Tools, Types of system, CAD/CAM system evaluation criteria, input and output devices. Graphics standard, functional areas of CAD, Modeling and viewing, Review of C, C++, statements such as if else for while & switch, functions, pointernotations, structure & class, concept of OOP. **4**

GEOMETRICMODELLING: Output primitives- Bresenham's line drawing and Mid-point circle algorithms. Types of mathematical representation of curves, wire frame models wire frame entities parametric representation of synthetic curves her mite cubic splines Bezier curves B-splines rational curves **3**

UNIT II:

SURFACE MODELING : Mathematical representation surfaces, Surface model, Surface entities surface representation, Parametric representation of surfaces, plane surface, rule surface, surface of revolution, Tabulated Cylinder. **3**

PARAMETRIC REPRESENTATION OF SYNTHETIC SURFACES – Hermite Bicubic surface, Bezier surface, B- Spline surface, COONs surface, Blending surface , Sculptured surface, Surface manipulation – Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D). **4**

GEOMETRICMODELLING-3D : Solid modeling, Solid Representation, Boundary Representation (B-rep), Constructive Solid Geometry (CSG). **3**

UNIT III :
CAD/CAM Exchange : Evaluation of data – exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS & DXF. **4**

Collaborative Engineering: Collaborative Design, Principles, Approaches, Tools, Design Systems. Introduction to CAD/CAE, Element of CAD, Concepts of integrated CAD/CAM, CAD Engineering applications, its importance & necessity. Finite Element Methods: Introduction and Application of FEM, Stiffness Matrix/ Displacement Matrix, One/Two Dimensional bar & beam element (as spring system) analysis. **7**

UNIT – IV

NC Part Programming-
Manual (word address format) programming. Examples Drilling and Milling. **5**

UNIT – V
System Devices- Introduction to DC motors, stepping motors, feed back devices such as encoder, counting devices, digital to analog converter and vice versa. **4**
Interpolators- Principle, Digital Differential Analysers. Linear interpolator, circulator

Interpolator and its software interpolator. Control of NC Systems- Open and closed loops. Automatic control of closed loops with encoder & tachometers. Speed variation of DC motor. Adaptive control **8**

References

1. CAD/CAM Theory and Practice – Ibrahim Zeid ,TMH
2. CAD/CAM – Groover & Zimmers Pearson
3. Computer Oriented Numerical Methods – Rajaraman PHI Learning
4. CAD/CAM by

TME-702 MAINTENANCE& SAFETY ENGINEERING **L T P**
3 1 0

Unit-I

Introduction, operating life cycle, reliability, Failure data analysis, failure rate curve, hazard models. maintainability, availability, reliability **4**

Unit-II

Maintenance Strategies: Break down maintenance, planned maintenance, strategies, preventive maintenance, design out maintenance, planned lubrication, total productive maintenance, zero break down, preventive inspection of equipment used in emergency. **6**

Unit-III

Replacement planning &maintain or replace decision, replacement of items that deteriorate with time identical equipment, replacement of items that fail without deterioration individual, group replacement, replacement in anticipation of failure. Break down maintenance planning **8**

Unit-IV

SAFETY IN ENGINEERING INDUSTRY:

Introduction - definitions - classification of engineering industry - different process in engineering industry. Safety in welding, cutting, finishing, Safety in heat treatments - safety in handling and storage,. disposal of effluents - health precautions, elimination and prevention of long time exposure to the hazardous fumes, source of fumes, ventilation and fume protection.**7**

Care and maintenance of common elements used in material handling equipments like rope chains slings, hooks , clamps .general safety consideration in material handling - manual and mechanical handling . Handling assessments - handling techniques – lifting, carrying, pulling, pushing, palletizing and stocking. Occupational diseases due to physical and chemical agents. **8**

Unit-V
Maintenance Management, production maintenance system, objectives and functions, forms, policy, planning, organization, economics of maintenance, manpower planning, materials planning, spare parts planning and control, evaluation of maintenance management. **8**

References
1) Industrial Safety Handbook : William Handley
2) Introduction to Safety Engineering : David S Gloss & Miriam GayleWardle
3) Industrial Safety : Roland P Blake
4) Health and Safety in Welding and allied process :N C Balchin,Jaico publishers
5.Management of systems – R.N. Nauhria & R. Prakash.

TME- 703: Energy Conservation

L T P
3 1 0

Unit -I

Energy Audit: Definition, Need and Objectives. **1**

Types of Energy Audit: Internal Audit, External Audit, Walk through Energy Audit, Preliminary Energy Audit, Detailed Energy Audit, Industrial Energy Audit, Utility (Services) Energy Audit, Commercial Energy Audit, Residential Energy Audit. **3**

Basic Components of Energy Audit: Preparing for Audit Visit, Instrumentation, Data Collection Techno-economic Analysis, Safety Considerations **2**

Unit -I I

Fuel Analysis

Proximate Analysis, Ultimate Analysis, Calorific Value. Combustion: Theoretical Air Requirement. **3**

Insulation and Refractories

Insulation Type and Application, Economic Thickness of Insulation, Heat Savings and Application Criteria, Refractory-Types, Selection and Application of Refractories,. **4**

Boilers:

Types, FBC Boilers ,Mechanism of Fluidized Bed Combustion, Saving Potential. Analysis of Losses, Performance Evaluation, Blow Down, Energy Conservation Opportunities. **5**

Unit -III

Steam System:

Properties of Steam, Assessment of Steam Distribution Losses, Steam Leakages, Steam Trapping, Condensate and Flash Steam Recovery System, Identifying Opportunities for Energy Saving. **5**

Cogeneration and Trigeneration

Need, Applications, Advantages, Combined Cycles, Saving Potential, **2**

Unit -IV

Waste Heat Recovery:

Availability and Reversibility, First and Second Law Efficiencies, Classification, Advantages and Applications, Commercially Viable Heat Recovery Devices, HVAC and Refrigeration System, Factors Affecting Refrigeration and Air Conditioning System Performance and Savings Opportunities., Distribution systems for conditioned air **6**

Compressed Air Systems

Types of air compressors, compressor efficiency, efficient compressor operation, compressed air systems components, capacity assessment, leakage test, factors affecting the performance and energy savings opportunities. Unit IV **4**

Pumps and Pumping System

Performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. 2

Unit V

Electrical Systems: Active power, reactive power and apparent power, star, delta connection, electrical load management and electrical billing **3**

Power Factor: Power factor, Power factor improvement and its benefit, selection and location of capacitors, and energy conservation opportunities. **2**

Electric Motors: Types, losses in induction motors, motor efficiency, factor affecting motor performance, rewinding and motor replacement issues, energy saving opportunities in motors, energy efficient motors, soft starter with energy savers. **5**

References

1. G. L. Witte, Phillips S.Scbmidt and Daid R. Brown, Industrial Energy Management and Utilization, Hemisphere Publishing Corporation, Washington
2. Carig,B. Saith, Energy Management Principles, Applications, Bnefit and Saving, Per n Press, New York.
3. F. W. Pyne, P *gm* Energy Conservation Manual, Fairmont Proem, INC.P.O. Box 14227 Atlanta,GA 30224
4. D. Patrick and S.W. Fardo, Energy U-sent and Conservation, Prentice Hall, INC Engleweek Cliffs (NJ) 7632.

5. W R Murphy & G McKay, Energy Management, Elsiver/BSP hyderabad

LIST OF ELECTIVES

Elective-I

TME-011 Non conventional energy resources

TME-012 Advanced Engineering Material

TME-013 Optimization Techniques in Engineering

TME-014 Advanced Welding Processes

TME-015 Non Destructive Testing

TME 011 : NON-CONVENTIONAL ENERGY RESOURCES AND UTILISATION **L T P**

3 1 0

UNIT-1

Energy resources and their utilization : Indian and global energy sources, Energy exploited, Energy planning, Energy parameters (energy intensity, energy-GDP elasticity), Introduction to various sources of energy, Solar thermal, Photovoltaic, Water power, Wind energy, Biomass, Ocean thermal, Tidal and wave energy, Geothermal energy, Hydrogen energy systems, Fuel cells, Decentralized and dispersed generation. 3

Solar radiations: Extra terrestrial radiation, Spectral distribution, Solar constant, Solar radiations on earth, Measurement of solar radiations, Solar radiation geometry, Flux on a plane surface, Latitude, Declination angle, Surface azimuth angle, Hour angle, Zenith angle, Solar altitude angle expression for angle between incident beam and the normal to a plane surface (no derivation), Local apparent time, Apparent motion of sun, Day length, Solar radiation data for India. 5

UNIT-2

Solar energy: Solar thermal power and it's conversion, Solar collectors, Flat plate, Performance analysis of flat plate collector, Solar concentrating collectors, Types of concentrating collectors, Thermodynamic limits to concentration, Cylindrical collectors, Thermal analysis of solar collectors, Tracking CPC and solar swing. Solar thermal energy storage, Different systems, Solar pond, Applications, Water heating, Space heating & cooling, Solar distillation, solar pumping, solar cooking, Greenhouses, Solar power plants Solar photovoltaic system: Photovoltaic effect, Efficiency of solar cells, Semiconductor materials for solar cells, Solar photovoltaic system, Standards of solar photovoltaic system, Applications of PV system, PV hybrid system.

7

UNIT-3

Biogas: Photosynthesis, Bio gas production Aerobic and anaerobic bio-conversion process, Raw materials, Properties of bio gas, Producer gas, Transportation of bio gas, bio gas plant technology & status, Community biogas plants, Problems involved in bio gas production, Bio gas applications, Biomass conversion techniques, Biomass gasification, Energy recovery from urban waste, Power generation from liquid waste, Biomass cogeneration, Energy plantation, Fuel properties, Biomass resource development in India.

5

Wind energy: Properties of wind, Availability of wind energy in India, wind velocity, Wind machine fundamentals, Types of wind machines and their characteristics, Horizontal and Vertical axis wind mills,

Elementary design principles, Coefficient of performance of a wind mill rotor, Aerodynamic considerations in wind mill design, Selection of a wind mill, Wind energy farms, Economic issues, Recent development. 5

UNIT-4

Electrochemical effects and fuel cells: Principle of operation of an acidic fuel cell, Reusable cells, Ideal fuel cells, Other types of fuel cells, Comparison between acidic and alkaline hydrogen-oxygen fuel cells, Efficiency and EMF of fuel cells, Operating characteristics of fuel cells, Advantages of fuel cell power plants, Future potential of fuel cells . 3

Tidal power: Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy Limitations of tidal energy conversion systems. Hydrogen Energy: Properties of hydrogen in respect of it's use as source of renewable energy, Sources of hydrogen, Production of hydrogen, Storage and transportation, Problems with hydrogen as fuel, Development of hydrogen cartridge, Economics of hydrogen fuel and its use.. 4

UNIT-5

Thermoelectric systems: Kelvin relations, power generation, Properties of thermoelectric materials, Fusion Plasma generators. 2

Geothermal energy: Structure of earth's interior, Geothermal sites, earthquakes & volcanoes, Geothermal resources, Hot springs, Steam ejection, Principal of working, Types of geothermal station with schematic representation, Site selection for geothermal power plants. Advanced concepts, Problems associated with geothermal conversion. 4

Ocean energy; Principle of ocean thermal energy conversion, Wave energy conversion machines, Power plants based on ocean energy, Problems associated with ocean thermal energy conversion systems, Thermoelectric OTEC, Developments of OTEC, Economics. Impact of renewable energy generation on environment, Kyoto Protocol, Cost of electricity production from different energy sources, Energy options for Indian economy.

4

Reference Books:

1. Duffle and Beckman, Solar Thermal Engineering Process, John Wiley & Sons, New York
2. H.P. Garg, Advanced in Solar Energy Technology, D. Reidel Publishing Co., Drdricht.
3. S.P. Sukhatme, Solar Energy, Tata McGrew Hill Company Ltd., New Delhi
4. Twidell & AW. Wier, Renewable energy resources, English Language book, Society / E& FN Spon (1986).
5. N.K. Bansal., M. Kleeman & M. Mielee, Renewable conversion technology, Tata McGraw Hill, New Delhi.

TME-012 ADVANCE ENGINEERING MATERIALS **L T P**
3 1 0

UNIT-I

Ferrous Materials, their Properties and Applications: Plain carbon steels, their properties and application: plain carbon steels, effects of alloying elements in plain carbon steels. Alloy steels, tools steels, stainless steels, low and high temperature resisting steels, high strength steels, selections, specifications, form and availability of steel. Cast irons-white, grey, modular malleable and alloy cast irons. Recognized patterns of distribution of graphite flakes in grey cast iron. 5

UNIT-II

Heat Treatment of Steels TTT diagrams, annealing, normalizing, hardening and tempering of steel. Austempering and martempering of steel. Hardenibility, Journing end quench test. Grauisis and its determination. Effect of graion the properties of steel. 4

Surface hardening of steel :

Carbonising nitriding carbonitriding cyniding, flues and inducation hardenirng microscopic determination of case depth and depth of hardening. 4

Unit-III Nonferrous materials, their properties and application, brasses, bronzes, cupro-nickel alloys, aluminum, magnesium and titanium alloys, bearing materials, selection, specific form and availability. Heat treatment of nonferrous materials – soputionising and precipitations hardening 4

Unit-IV

Composites

Polymer – polymer, metal-metal, ceramic –ceramic, ceramic-polymer, metal-ceramic, metalpolymer composites. Dispersion reinforced, particle reinforced, laminated and fibre reinforced composites. 5

UNIT-V

ELASIOMERS AND MASULLANEOUS Types, properties and identifications of different types of rubbers vulcanisation, fabrication andforming techniques of rubber. Introduction of plastics and ceramics – types, application and process. Smart materials-introduction and types. Selection of materials and factors effecting deflection, Selection process and systematic evaluation. 6

TME-013 OPTIMISATION TECHNIQUES IN ENGINEERING **L T P**
3 1 0

Unit-I

Unconstrained Optimization: Optimizing Single-Variable Functions, conditions for Local Minimum and Maximum, Optimizing Multi-Variable Functions. 4

Unit-II

Constrained Optimization: Optimizing Multivariable Functions with Equality Constraint: Direct Search Method, Lagrange Multipliers Method, Constrained Multivariable Optimization with inequality constrained: Kuhn-Tucker Necessary conditions, Kuhn –Tucker Sufficient Conditions. 6

Unit-III

Optimization: Quasi-Newton Methods and line search, least squares optimization, GaussNewton, Levenberg- Marquartd, Extensions of LP to Mixed Integer Linear Programming (MILP), Non-Linear Programming, The Newton Algorithm, Non-Linear Least Squares, Sequential Quadratics Programming (SQP), Constrained Optimization, SQP Implementation, Multi-Objective Optimization, Branch and Bound Approaches, Genetic Algorithms and Genetic Programming, Singular Based Optimization, On-Line Real-Time Optimization, Optimization in Econometrics Approaches – Blue. 8

Unit-IV

Optimization and Functions of a Complex Variable and Numerical Analysis: The Finite Difference Method for Poisson's Equation in two Dimensions and for the Transient Heat Equation, Eulers Method, The Modified Euler Mehtod and the Runge-Kutta Method for Ordinary Differential Equations, Gaussian Quardative Tranzoidal Rule and Simpson's 1/3 and 3/8 Rules, the Newton Raphson in one and two Dimensions, Jacobi's Iteration Method. 8

Unit-V

Optimization in Operation Research: Dynamic Programming, Transportation – Linear Optimization Simplex and Hitchcock Algorithms, Algorithms, Minimax and Maximum Algorithm, Discrete Simulation, Integer Programming – Cutting Plane Methods, Separable Programming, Stochastic Programming, Goal Programming, Integer Linear Programming, Pure and Mixed Strategy in theory of Games, Transshipment Problems, Heuristic Methods. 8

Books.

1. Winston W L: Operations Research: Applications and Algorithms

2. Rao S.S., Optimization: Theory and Applications.

3. Walsh G R: M methods of Optimization.

TME014 ADVANCED WELDING TECHNOLOGY **L T P**
3 1 0

Unit-I

Introduction : Importance and application of welding, classification of welding process.

Selection of welding process. Review of conventional welding process : Gas welding, Arc welding, MIG, TIG welding. Resistance welding. Electroslag welding, Friction welding etc. Welding of MS.CI, Al, Stainless steel & Maurer/Schacfflar Diagram. Soldering & Brazing. 6

Unit-II Advanced welding Techniques- Principle and working and application of advanced welding techniques such as Plasma Arc welding, Laser beam welding, Electron beam welding, Ultrasonic welding etc. 4

Unit-III Advanced welding Techniques (continued) : Principle and working and application of advanced welding techniques such as explosive welding/ cladding, Underwater welding, Spraywelding / Metallising, Hard facing. 5

Unit-IV Weld Design : Welding machines/equipments and its characteristics. Weld defects and distortion and its remedies, Inspection/testing of welds, Macrostructure & microstructure of welds, HAZ, Weld Design, Welding of pipe-lines and pressure vessels. Life predication. 4

Unit-V Thermal and Metallurgical consideration.: Thermal considerations for welding, temperature distribution, Analytical analysis, heating & cooling curves. Metallurgical consideration of weld, HAZ and Parent metal, micro & macro structure. Solidification of weld and properties. 6

Books

Welding Hand Book

TME-015 Non Destructive testing **L T P**
3 1 0

Unit-1

INTRODUCTION:

Scope and advantages of N.D.T. some common NDT methods used since ages – visual inspection, Ringing test, and chalk – test (oil-whiting test) their effectiveness in detecting surface cracks, bond strength and surface defects. 5

Unit-2

Common NDT methods Dye – penetrant tests – principle, scope, equipment and techniques. Zyglo testing. Magnetic Particle Tests- Scope of test, Principle equipment and technique. DC And AC magnetization, use of day and wet powders magnaglow testing. Interpretations of results. 6

Unit-3

RADIOGRAPHIC METHODS X-ray radiography – principle, equipment and methodology. Interpretation of radiographs, Limitations Gamma ray radiography. Principle, equipment, source of radioactive material and technique. Precautions against radiation hazards, Advantage over x-ray radiography methods. 6

Unit-4

ULTRASONIC TESTING METHODS Introduction Principle of Operation – piezoelectricity. Ultrasonic probes, cathode ray oscilloscope techniques and advantages limitation and typical applications. 4

Unit-5

Testing of castings, forgings & weldments Application of NDT methods in inspection of castings, forgings and welded structures with illustrative examples. Case studies. Sample-testing in the lab. 6

TME-751
CAD/CAM Lab
10 experiments (6 from CAD experiments, 4 from CAM experiment)

A. CAD Experiments-
1. Line drawing or Circle drawing algorithm experiment : writing the program and running it on computer.
2. Transformations algorithm experiment for translation/rotation/scaling : writing program and running it on computer.
3. Design problem experiment : writing the program for design of machine element or other system and running it on computer.
4. Optimisation problem experiment : writing a program for optimising a function and runing it on computer.
5. Auto CAD experiment : understanding and use of Auto CAD commands.
6. Writing a small program for FEM for 2 spring system and running it. Or using a FEM package.
7. Use of Graphic software standards packages e.g. GKs/PHICS/GL etc.
8. Use of pro Engineer/Ideas etc.
B. CAM experiments-
1. Writing a part-programming (in word address format or in APT) for a job for drilling operation (point-to-point) and running on NC machine.
2. Writing a part programming (in word address format or in APT) for a job for milling operation (contouring) and running on NC machine
3. Experiment on Robots and it programs
4. Experiment on Transfer line/Material handling.
5. Experiment on difference between ordinary machine and NC machine, study or retrofitting.
6. Experiment on study of system devices such as motors and feed back devices.
7. Experiment on Mechatronics & controls

TME-801 POWER PLANT ENGINEERING **L T P**
3 1 0

Unit-I

Introduction:
Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion, calculations. Variable Load problem Industrial production and power generation compared, ideal and realised load curves, terms and factors. Effect of variable load on power plan operation, methods of meeting the variable load problem. Power plant economics and selection Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor's profit; depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection. 8

Unit-II

Steam power plant
Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boilers mountings and accessories. General layout of steam power plant. Different systems such as fuel handling system, pulverizes and coal burners, combustion system, draft, ash handling system, feed water treatment and condenser and cooling system, turbine auxiliary systems such as governing, feed heating, reheating , flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency**.** **8**

Unit-III
Diesel power plant

General layout, performance of diesel engine, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, diesel plant operation and efficiency, heat balance. Gas turbine power plant Elements of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, Combined cycle power plants. 6

Unit-IV

Hydro electric station
Principles of working, applications, site selection, classification and arrangements, hydroelectric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems, micro and mini hydro power plant. 6

Unit-V Nuclear power plant

Principles of nuclear energy, basic components of nuclear reactions, nuclear power station. Nuclear fuels in fission and fusion reactors, Types of nuclear reactors, Fissile and fertile materials, Neutron chain reaction in fission reactors, Neutron flux, Concept of criticality for bare homogeneous reactors, Coolants, moderators, Control and structural materials. Heat generations and steady state temperature distribution in fuel elements, Heat removal.

8

Books:

1. Nuclear Reactor Engineering By S. Glastone and A . Sesonske.
2. Basic Nuclear Engineering, by K.S. Ram.
3. Introduction to Nuclear Engineering, by J.R lamarsh.
4. “Power Plant Engineering” F.T. Morse, Affiliated East-West Press Pvt. Ltd, New Delhi/Madras.
5. “Power Plant Engineering” Mahesh Verma, Metropolitan Book Company Pvt. Ltd. New Delhi.
6. “Power Plant Technology” El-Vakil, McGraw Hill.
7. Power Plant Engineering by P.K. Nag, Tata McGraw Hill.
8. Steam & Gas Turbines & Power Plant Engineering by R.Yadav, Central Pub.House.

TME-802

AUTOMOBILE ENGINEERING **L T P**
3 1 0

Unit-I

INTRODUCTION: Classification of automobile, Parts of an automobile, Description of an automobile, performance of automobile, engine cycle-energy balance, terms connected with I.C. Engines, Detonation, performance number, tractive efforts. 5

FUEL-SUPPLY SYSTEM:

S.I. ENGINE: Carburetion & carburetors, Induction system, factor influencing carburetion, Mixture requirement, Distribution, Complete carburetor, theory of simple carburetor. 4

C.I. ENGINE: Functional requirements of an injection system, Fuel pump and fuel injector (Atomizer), Types of nozzles and fuel spray patterns, troubleshooting of a fuel system & carburetor, Turbo Charger (Function and benefits). 4

Unit II

ENGINE FRICTION, LUBRICATION & COOLING SYSTEM:

Determination of engine friction, Lubrication, lubrication system, Crankcase ventilation, Necessity of engine cooling, Areas of heat flow in engines, gas temperature variation, heat transfer, temperature distribution & temp. profiles, cooling air and water requirements, cooling systems, troubleshooting of cooling system, gear box (Problems). 8

Unit III

CHASSIS: Introduction. Classification of chassis, Frame.

SUSPENSION: Introduction, requirements of suspension system, springs, damper.

WHEELS: Introduction, Requirement, types of wheels.

TYRES: Introduction, requirements, types of tyre, tyre construction-cross ply, radial ply, belted bias, tyre materials tyre shape, tread patterns, tyre markings, tyre inflation pressure, causes of wear, factors affecting tyre life, wheel balancing, wheel alignments. 6

Unit IV

STEERING AND GEARS: Purpose, function, requirements, general arrangements of steering systems, steering gears, steering ratio, reversibility, steering geometry, under steering, over steering, steering arms, Drag link, power steering, adjusting of steering geometry, steering troubleshooting. Requirements. Clutches. Toque converters. Over drive and free wheel,Universal joint. Differential Gear Mechanism of Rear Axle. Automatic transmission, Steering and Front Axle. Castor Angle, 5

FRONT AXLE: Introduction, construction, types of front axles, stub axles. 2

BRAKING SYSTEM: Necessity, functions, requirements, classification of brakes, Mechanical brakes, hydraulics brakes, power brakes, brake effectiveness, brake shoe holding down arrangements, brake tester, brake service, troubleshooting chart of hydraulic brakes system, air brakes & Brake shoes & drums. 3

UNIT V

AUTOMOTIVE ELECTRICAL SYSTEM: Introduction, main parts of vehicles.

STARTING SYSTEM: Introduction, battery, starting motor.

IGNITION SYSTEM: Introduction, purpose, requirements, coil ignition system, firing order, ignition timing, spark plugs, troubleshooting.

CHARCHING SYSTEM: Introduction. Dynamo, alternators.

LIGHTING: introduction, main circuits, lighting system.

Maintenance system: Preventive maintenance, break down maintenance, and over hauling system. 7

References-

1. Automotive Engineering- Hietner

2. Automobile Engineering - Kripal Singh.

3. Automobile Engineering - Narang.

4. Automotive Mechanics- Crouse

5. Automobile Engg. – K.N.Gupta

LIST OF ELECTIVES

Elective-II

TME-020 Total Quality Management (TQM)

TME-021 Advanced Fluid Mechanics

TME-022 Mechatronics

TME-023 Finite Element Method

TME O24 Six Sigma and Applications

Elective-III

TME-030 Experimental stress analysis

TME-031 Thermal Turbo Machines

TME-032 Robotics and automation

TME-033 Machine Tool Design

TME-034 Unconventional Manufacturing Processes

TME-020 TOTAL QUALITY MANAGEMENT (TQM) **L T P**
3 1 0

Unit-I

Quality Concepts Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type. Control on Purchased Product Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. Manufacturing Quality Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims. 5

Unit-II

Quality Management Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme. Human Factor in Quality Attitude of top management, co-operation, of groups, operators attitude, responsibility, causes of operators error and corrective methods. 6

Unit-III

Control Charts Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts. Attributes of Control Charts Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart. 7

Unit-IV

Defects Diagnosis and Prevention Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle. 6

Unit-V

IS0-9000 and its concept of Quality Management:

ISO 9000 series, Taguchi method, JIT in some details 5

References:

1. Lt. Gen. H.Lal, "Total Quality management", Wiley Eastern Limited, 1990. .

2. Greg Bounds. “Beyond Total Quality Management”. McGraw Hill, 1994.

3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992.

TME-021 ADVANCED FLUID MECHANICS **L T P**
3 1 0

UNIT-I

Review of kinematics of fluid motion, method of describing fluid motion, translation, rate of deformation, the material derivatives, acceleration, vorticity in Cartesian & polar coordinates, Reynolds transport theorem, Stress at a point, velocity profile, wall shear stress. 4

UNIT-II

Non-viscous incompressible flow- Equation of continuity, Euler's equation of motion, Bernoulli's equation, circulation and its theorem, stress function, velocity potential, irrotational flow, two dimensional source, sink, source-sink pair, doublet vortex, superposition of sourcesink with rectilinear flow, Rankine body, Superposition of rectilinear flow and doublet, flow around a spinning circular cylinder, Magnus effect, lift & Drag, Skin friction. Lift of aerofoil. 7

UNIT-III

Boundary layer Concept-Introduction to boundary layer formation, Novier-stokes equation, Boundary layer thickness, momentum thickness, energy thickness, Boundary layer equations, Momentum-Integral equation - Von Korman, Blasius solution of boundary layer on a flat plate without pressure gradient, Flow with very small Reynolds number, Hogen poisseuille flow, Plane Couette flow, Hydrodynamic theory of lubrication. 8

UNIT-IV

Compressible flow- Propagation of pressure change, sound velocity, elastic waves, Mach number, Mach cone, isentropic flow relations in terms of sonic velocity and mach number, Stagnation properties, Regions of flow, Energy equation, Effect of Mach number on compressibility. Propagation of infinitesimal waves, Non-steep finite pressure wave and steep finite pressure waves, Expansion waves Isentropic flow with variable area, Mach number variation and its effect on Flow through nozzles and diffusers. Area ratio, impulse function, Use of Gas/Air tables. 6

UNIT-V

Flow with normal shock waves- Development of shock wave, rarefaction wave, governing equations, Prandtle-Meyer relation. Thermodynamic properties across shock. Wind tunnels. Flow in constant area duct with friction-Fanno curves, Fanno flow equations, Solution of fanno flow equations. Variation of flow properties. Tables & charts for Fanno flow. Flow in constant area duct with heat transfer- Rayleigh line, Fundamental equations, Rayleigh flow relation, Variation of flow properties. Tables & Charts for Rayleigh flow. 8

References:

1. Fluid Mechanics by White.

2. Fluid Mechanics by Streeter

3. Fluid Mechanics by Som & Biswas

4. Fluid Mechanics by K.L. Kumar

5. Gas Dynamics by E. Radhakrishnan

TME-022 MECHATRONICS

Section – I

L	T	P
3	1	0

1 Review of Microprocessors and Micro Controllers: Concepts, Binary numbers to hexadecimal details, information on flipflops, gates, registers, counters, memory, polling and interrupts etc. Architecture, instruction set for 8085, 8051 and assembly level language. Difference between microprocessors and micro controllers. Introduction to programming. Signal and Data Processing: Concepts and principles, analogue signal conditioning, signal level changes, linearization, conversion, filtering. Impedance matching passive circuits. Specifications and circuits in instrumentation. Digital signal conditioning. 7

2 Ladder Diagram Fundamentals:Basic Components and their symbols, Fundamentals of ladder diagrams, Machine Control Terminology. The Programmable Logic Controller : A Brief History, PLC configurations, System Block Diagrams, Update Solve the ladder – Update, Update, Solve the Ladder 6

3 Fundamentals of PLC Programming: Physical Components Vs Program, components, Lighting Control Example, Internal Relays, Disagreement Circuit, Majority Circuit, Oscillator, Holding contacts, Always ON and Always OFF Contacts, Ladder Diagram Having more than one rung. Programming On/Off Inputs, to produce on – off outputs : Introduction, PLC input instructions, outputs : Coils, Indicators and others, Operational procedures, Contact and Coil Input output programming Examples, Fail Safe Circuits, Industrial Process Examples. 8

4 Creating Ladder Diagrams from Process Control Descriptions:Introductions, Ladder Diagrams, Sequence Listings. Large Process Ladder diagram Constructions, Flowcharting as programming Method. Introduction to Robotics: Elementary treatment on anatomy, drives, transmission and end effectors of Robotics 6

5 Material Handling: Generations Considerations, Applications in material transfer and loading unloading Assembly and Inspections : Assembly and robot assembly automations, Parts presentations methods., Assembly ope4rations, Assembly syst4m configurations inspe4ction automation. Introduction to Nano-technology. 5

Reference Books:

1 "Programmable Logic Controller – Principles and Applications" 5/e, J. W. Webb, R. A. Reis; Prentice Hall of India Ltd. ISBN 81-203-2308-4

2 "Industrial Robotics – Technology, Programming and Applications"; M. P. Groover, M. Weiss, R. N. Nagel, N. G. Ordey; McGraw Hill International Editions, Industrial Engineering Series, ISBN 0-0-100442-4

3 "Programmable Logic Controller – Programming methods and Applications" Hackworth JohnR. and Hackworth Frederick D. Jr.; Pearson Education LCE, ISBN 81-297-0340-8.

4 Introduction to 8085 – Gaonkar

TME-023 FINITE ELEMENT METHOD **L T P**
3 1 0

UNIT I Introduction to Finite Difference Method and Finite Element Method, Advantages and disadvantages 310
4

UNIT II

Mathematical formulation of FEM, Variation and Weighted residual approaches, Shape functions, Natural co-ordinate system, Element and global stiffness matrix, Boundary conditions, Errors, Convergence and patch test, Higher order elements. 5

UNIT III

Application to plane stress and plane strain problems, Axi-symmetric and 3D bodies, Plate bending problems with isotropic and anisotropic materials, Structural stability, Other applications e.g., Heat conduction and fluid flow problems. 5

UNIT IV

Idealisation of stiffness of beam elements in beam-slab problems, Applications of the method to materially non-linear problems, Organisation of the Finite Element programmes, Data preparation and mesh generation through computer graphics, Numerical techniques, 3D problems. 6

UNIT V

FEM, an essential component of CAD, Use of commercial FEM packages, Finite element solution of existing complete designs, Comparison with conventional analysis. 4

Books:

1. The Finite Element Method O.C. Zienkiewicz and R.L. Taylor McGraw Hill

2. An Introduction to Finite Element Method J. N. Reddy McGraw Hill

3. Finite Element Procedure in Engineering Analysis K.J. Bathe McGraw Hill

4. Finite Element Analysis C.S. Krishnamoorthy Tata McGraw Hill

TME 023 SIX SIGMA METHODS & APPLICATION **L T P**

Unit 1 **3 1 0**

Quality Perception : Quality in Manufacturing, Quality in Service Sector; Differences between Conventional and Six Sigma concept of quality; Six Sigma success stories. Statistical foundation and methods of quality improvement.

Descriptive statistics: Data Type, Mean, Median, Mode, Range, Variation, Standard Deviation, Skewness, Kurtosis.

Probability Distribution : Normal, Binomial, Poisson DistributionUnit 2

Basics of Six Sigma: Concept of Six Sigma, Defects, DPMO, DPU, Attacks on X'S, Customer focus, Six Sigma for manufacturing, Six Sigma for service. Z score, Understanding Six Sigma organization, Leadership council, Project sponsors and champions, Master Black Belt, Black Belt, Green Belts.

Unit 3

Methodology of Six Sigma, DMAIC, DFSS, Models of Implementation of Six Sigma, Selection of Six Sigma Projects.

Unit 4

Six Sigma Tools: Project Charter, Process mapping, Measurement system analysis, Hypothesis Testing, Quality Function deployment, Failure mode effect analysis, Design of Experiments.

Unit 5

Sustenance of Six Sigma, Communication plan, Company culture, Reinforcement and control, Introduction to softwares for Six Sigma, Understanding Minitab, Graphical analysis of Minitab plots.

References:

1. Six Sigma: SPC and TQM in manufacturing and service, Geoff Tennant, Gower Publishing

Co.

2. Six Sigma for managers, Greg Brue, TMH

3. What is Six Sigma, Pete Pande, TMH

4. The Six Sigma Way, Peter S. Pande, TMH Team Field book

5. The Six Sigma way, Peter S. Pande, TMH

TME 030 EXPERIMENTAL STRESS ANALYSIS **L T P**
3 1 0

UNIT I

Elementary Elasticity:

Stress: Introduction, Stress Equations of Equilibrium, Laws of Stress Transformations, principal Stresses, Two-Dimensional State of Stress, Stresses Relative to Principal Co-ordinate System, Special States of Stress. Strain: Introduction, Displacement and Strain, Strain Transformation Equation, Principal Strains, Compatibility, Volume Dilation, Stress Strain Relations, Strain Transformation Equations and Stress Strain Relations for Two-Dimensional State of Stress. 7

UNIT II

Strain Measurements: Introduction, Properties of Strain Gage Systems, Types of Strain Gages, Grid-Method of Strain Analysis. Brittle Coating Method: Coating Stresses, Failure Theories, Brittle Coating Crack Patterns, Resin and Ceramic Based Brittle Coating, Test Procedure, Analysis of Brittle Coating Data. 7

UNIT III

Electrical Resistance Strain Gages: Introduction, Strain Sensitivity in Alloys, Strain Gage Adhesives, Gage Sensitivity and Gage Factor. Strain Gage Circuit: Potentiometer and its Application, Wheat-Stone Bridge, Bridge Sensitivity, Null Balance Bridges. Analysis of Strain Gage Data: Three Element Rectangular Rosette, Delta Rosette, Stress Gage, Plane Shear-Gage. 8

UNIT IV

Theory of Photoelasticity: Introduction, Temporary Double Refraction, Stress Optic Law, Relative Retardation, Stressed Model in Plane Polariscope, Effect of Principal Directions, Effect of Principal Stress Difference, Stressed Model in Circular Polariscope, Light and Dark Field arrangements, Tardy Compensation, Fringe Sharpening and Multiplication by Partial Mirrors. 7

UNIT V

Two Dimensional Photoelasticity : Introduction, Isochromatic Fringe Patterns, Isoclinic Fringe Patterns, Compensation Techniques, Calibration Methods, Separation Methods, Shear Difference Method, Electrical Analogy Method, Oblique Incidence Method, Materials for TwoDimensional Photoelasticity. 6

References:

1. Experiment Stress Analysis by James W. Dally and William F. Riley, International Student

Edition, McGraw-Hill Book Company.

2. Experiment Stress Analysis by Dr. Sadhu Singh, Khanna Publishers.TME-043

TME 031 THERMAL TURBO MACHINES **L T P**
3 1 0

UNIT-I

Brief history of turbo machinery, introduction to blowers, pumps, compressors, steam & gas turbines, turbojet, Review of laws of thermodynamics & SFEE in reference to turbo machinery, Energy transfer in turbo machines, Euler's equation, Velocity diagrams for axial & radial turbo machinery and pumps. Definition of various efficiencies, Introduction to blowers, pumps, compressors, steam & gas turbines turbojet. 6

UNIT-II

Centrifugal compressors- Principle of operation, work done and pressure rise, Diffuser, state losses, ship factors, Performance, characteristics. Axial flow compressor- basic operation, Elementary theory, Factors affecting stage pressure ratio, Blockage in compressor annulus, Degree of reaction, 3-D flow, Design process, blade design, calculation of stage performance. Supersonic & transonic stages, Performance. 7

UNIT-III

Axial flow turbines-Elementary theory of axial flow turbine, Vortex theory, Choice of blade profile, pitch and chord, Estimation of stage performance. 5

UNIT-IV

Steam turbines- Constructional details, working of steam turbine.

Pumps : Pumps, main components, indicator diagram and modification due to piston acceleration, performance and characteristics, axial flow pumps.

Radial flow turbines: Single velocity triangle Enthalpy- Entropy diagram, State losses, performance, Characteristics. 7

UNIT-V

Gas Turbine Starting & Control Systems: Starting ignition system, combustion system types, safety limits & control. 3

Turbine Blade coding: Cooling techniques, types Mechanical Design consideration: Overall design choices, Material selection, Design with traditional materials. 3

References:

1. Gas turbine theory : Gohen & Rogers, Addison Weslay Longman Ltd.

2. Design of high efficiency turbomachinery and gas turbines, David Gordon Wilson,

Theodosios Korakianitis, Prentice Hall International.

3. Turbomachinery : S.M. Yahya.

4. Turbine, Compressors and Fans, S.M. Yahya, Tata Mc Graw Hill.

5. Gas Turbine- Ganeshan, Tata Mc Graw HillTME 044

TME 032 ROBOTICS AND AUTOMATION **L T P**
3 1 0

Unit I

Introduction : Brief history, robot terminology, classification, characteristic, physical configuration, structure of industrial robot. Robot and Effectors: Types, mechanical grippers, other types of gripper, tools as end effectors, Robot/end effector interface, design consideration. 4

Robot Motion Analysis & Control : Introduction to manipulator kinematics, robot dynamics,

manipulator dynamics, robot control, task planning. 5

Unit II

Sensors : Transducers and sensors, sensors in robotics, tedile sensors, proximity and range sensors, miscellaneous sensors and sensor-based systems, use of sensors in robotics, touch sensors, force-torque sensors. 6

Machine Vision: Introduction, sensing and digitizing function in machine vision, image processing and analysis, vision system robotic applications. 3

Unit III

Programming : Basics of robot programming, languages, commands, communications and data processing.

Applications : Welding, electro-plating, painting, spraying, assembling, material handling, inspection, Future applications. Introduction to design of robot in specific applications. 6

Unit IV

Fundamentals of Manufacturing Automation: Basic Principles of automation, types of automated systems, degrees of automation,Automated flow lines. Automation for machining operations Design and fabrication considerations.Analysis of multi station assembly. 4

Automated Material Handling: components, operation, types, design of automated guided vehicles and applications. 2

Automated storage / retrieval systems - types, basic components and applications. 2

Unit V

Group Technology: Part families, part classification and coding, machine Cell design, Benefits. Computer Aided Process Planning, benefits and limitations.

Automated Inspection And Testing: Automated inspection principles and methods sensors techniques for automated inspection-techniques for automated inspection-contact and noncontact inspection methods-in process gauging, CMM's, construction, types, inspection probes, types, and applications. Machine vision, LASER Micrometer and optical inspection methods. 6

Reference Books:

1. Industrial Robotics (Technology, Programming and applications) – Mc Graw Hill Editions

2. Robotics – An introduction - Douglas R. Malcolm. Jr -- Delmar Publisher Inc

3. Robot technology fundamentals - Saures G. Keramas - Delmar publishers

4. Fundamentals of robotics – analysis & control - Robert J. Schilling – (PHI) edition

TME-033 MACHINE TOOL DESIGN **L T P**
3 1 0

Unit-I

Introduction: Developments is machine tools, types of machine tools surface, profits and paths produced by machine tools. Features of construction and operations of basic machine tools e.g. lathe, drill, milling shapes and planers, grinding machine etc. General requirement of machine tool design. Machine tool design process. Tool wear, force Analysis. 5

UNIT-II

Machine Tools Drives: Classification of machine tool drives, group Vs individual drives, Selection of electric motor, A brief review of the elements of mechanical transmission e.g. gear, belt and chain drives, slider-crank mechanism, cam mechanism, nut & Screw transmission, Devices for intermittent motion, reversing & differential mechanisms. Couplings and clutches Elements of hydraulic transmission system. e.g. pumps, cylinder, directional control valves, pressure valves etc. Fundamentals of Kinematics structure of machine tools. 7

Unit-III

Regulation of Speed and Feed rates : Laws of stepped regulation, selection of range ratio, standard progression ratio, selection of best possible structural diagram, speed chart, Design of feed box, Developing gearing diagrams. Stepless regulation of speed and feed in machine tool, speed and feed control. 7

Unit-IV

Design of Machine Tool Structure: Requirements and design criteria for machine tool structures, selection of material Basic design procedure for machine tool structures, design of bed, column and housing, Model technique in design. Design of guide ways and power screws: Basic guide way profiles, Designing guide way for stiffness a wear resistance, hydrostatic and antifriction grand ways. Design of sliding friction power Screws. Design of spindlier & spindle supports. Layout of bearings, selection of bearings for machine tools 8

Unit-V

Dynamics of machine tools: General procedure for assessing the dynamic stability of cutting process, closed loop system, chatter in machine tools.Control Systems : Functions, requirements & types of machine tool controls, controls for speed & feed change. Automatic and manual Controls. Basics of numerical controls. Machine tool testing. 6

References:

1. Machine Tools Design & Numerical Controls –N.K. Mehta, T.M.H. New Delhi.

2. Design of Machine Tools – S.K. Basu Allied Publishers.

3. Principles of Machine Tools, Bhattacharya A and Sen.G.C. New Central Book Agency.

TME034 UNCONVENTIONAL MANUFACTURING PROCESSES **L T P**
3 1 0

Unit-I

Introduction: Limitations of conventional manufacturing processes, need of unconventional manufacturing processes and its classification.

Unit-II

Unconventional Machining Process: Principle and working and applications of unconventional machining process such as Electro-Discharge machining, Electro-chemical machining, ultrasonic machining, Abrasive jet machining etc.

Unit-III

Principle and working and application of unconventional machining processes such as laser beam machining, Electron beam machining, Ultrasonic machining etc.

Unit-IV

Unconventional welding processes: Explosive welding, Cladding etc. Under water welding,Metallising, Plasma are welding/cutting etc.

Unit-V

Unconventional Forming processes: Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-Discharge forming, water hammer forming, explosive compaction etc.

Books:

1. Modern Machining Processes – P.C. Pandey

2. Unconventional Machining – V.K. Jain

3. Modern Machining – G.F. Benedict

OME 005 Energy Efficient Buildings

L	T	P
3	1	0

Energy Efficient Building Design Strategies

Energy use in Buildings, Factors effecting Energy use, Energy Conservation options. External Factors – Climate, Building Orientation, Shading, types of shading devices.

Thermal Comfort

Criteria and various Parameters, Psychometric Chart, Thermal Indices. Indoor air quality; Requirements in residential, Commercial, Hospital Buildings.

Passive concepts and components

(a) passive heating concepts direct gain, indirect gain, isolated gains and suspenses;(b) passive cooling concepts - evaporative cooling, evaporative air and water coolers, radiative cooling, application of wind, water and earth for cooling ,use of isolation, shading, paints and cavity walls for cooling; (c) passive heating and cooling concepts - roof pond/sky therm, roof radiation trap, vary-therm wall, earth sheltered or earth based structures and earth airtunnels; selective ventilation, components- windows and thermal storage

Heat Transmission in Buildings: Surface Coefficient, Air cavity, Internal and External Surface, Overall Thermal Transmittance Walls and Windows, and Packed Roofthached Heat Transfer due to ventilation/ infiltration, Building loss coefficient Internal Heat gains, Solar Temperature, Steady State Method (for Trombe Wall, Water wall and Solarium), Degree Day method.
Correlation methods - solar load ratio, load collector ratio, thermal time constant method, Analytical methods - thermal circuit analysis, admittance procedure of metrics. The periodic solutions - thermal modeling of AC / Non AC buildings.

Typical Designs of Selected Buildings in various Climatic Zones, Thumb Rules for Design of Building systems and Building Codes.

Reference Books

1. M.S.Sodha, N.K. Banaal, P.K.Bansal, A.Rumaar and M.A.S. Malik, Solar Passive: Building Science and Design, Pergamon Preen (1986).
2. Jamee; L. Threlked, Thermal Environment Engineering, Prentice Hall, INC-, Raglevood Cliffs, New Jersey (1970)
3. T.A. Markus and R.N. Morris, Building, Climate and Energy Spottwoode Ballantype Ltd-, London U.K. (1980)
4. Solar Thermal Energy Storage, H. P. Garg et.al, D. Reidel Publishing Company (1985)
5. Mathematical Modeling of Melting and Freezing Process, V Alexiades & A.D. Solomon, Hemisphere Publishing Corporation, Washington (1993)
6. Energy storage technologies, a reading material prepared by Dr. D. Buddhi, School Of Energy And Environmental Studies, DAVV, Indore.

List of Open Electives to be Offered by the Mechanical Engineering

OME-001 Optimization Techniques in Engineering

OME-002 Robotics and automation

OME-003 Advanced Engineering Materials

OME-004 Computer Integrated Manufacturing

OME-005 Energy Efficient Buildings